Carbon Farming Workshop

SOIL HEALTH INSTITUTE
Enriching Soil, Enhancing Life

Jason Ackerson, PhD

Research Soil Scientist

jackerson@soilhealthinstitute.org

Relevant experience bio sketch

- Soil scientist with experience in digital soil mapping, proximal soil sensing, and pedometrics
- Developing techniques for in-situ measurement of soil organic carbon stocks using proximal sensing
- Working with commercial partners to develop large-scale (e.g. multiple states) soil carbon quantification methodology for voluntary, agricultural, soil carbon offset markets

Networking & teaming

- We have developed methods to accurately measure soil organic carbon stocks at scale via reduced measurement cost and improved sampling and monitoring methods.
- Seeking partners interested in novel approaches to MRV that integrate in-situ SOC measurement and intelligent sampling strategies.

Ideas, questions, and feedback

- Carbon Farming: Mitigating climate change with an integrated, carbon-conscious agricultural economy
- Risk: Unintended ecological, sociological, and agronomic consequences of soil organic carbon as a commodity
- Inspired by advancements in MRV to integrate multiple data streams

Carbon Farming Workshop

Jim Amonette Pacific Northwest NATIONAL LABORATORY
Proudly Operated by Battelle Since 1965

Senior Res Geochemist &
Res Prof of Soil Chemistry

Jim.Amonette@wsu.edu
Jim.Amonette@pnnl.gov

Relevant experience bio sketch

- Environmental geochemist/soil mineralogist with 4 decades experience:
  - Silicate mineral weathering
  - Surface chemistry of carbonate minerals
  - Geologic carbon sequestration
  - Soil carbon storage
  - Biochar technology
  - Climate life cycle assessment
  - Field monitoring of GHG emissions
  - Slow-release solid nitride N fertilizer
- Joint Appointment at PNNL and WSU

Networking & teaming

- I work at the intersection of 3 terrestrial drawdown technologies:
  Biochar + Soil C Storage + Enhanced Mineral Weathering
- I'm hoping to connect with other researchers and practitioners interested in cross-disciplinary approaches to address climate change

Ideas, questions, and feedback

- *In 10 words or less, what is carbon farming?*
  - Enhanced drawdown and storage of carbon by terrestrial processes
- *What is the primary risk of carbon farming?*
  - Premature release of stored carbon
- *What ideas in the community are inspiring you right now?*
  - Synergy among terrestrial drawdown approaches

Carbon Farming Workshop

Dr. Tyler Anthony

Postdoctoral Researcher

t.anthony@berkeley.edu

In Whendee Silver's lab at UC Berkeley we study the interactions between ecosystem biogeochemistry and climate change.

We focus on how land management and soil amendments affect C sequestration and greenhouse gas emissions.

We use rigorous, cutting-edge approaches to quantify effects of organic and mineral soil amendments across managed ecosystems.

Networking & teaming

- **We conduct field, lab, and modeling research on the effects of soil amendments (organic and inorganic) on C sequestration *and* greenhouse gas emissions reductions. We also explore mechanistic drivers, net primary production, and plant community dynamics.**
- **We are interested in exploring potential collaborations on soil C sequestration research and connections that can help scale field experiments to larger *applied* C reduction pathways**

Ideas, questions, and feedback

- **Carbon farming is the use of managed ecosystems to remove atmospheric CO_2.**
- **We don't know if it will work everywhere.**
- **We have data showing that amendments work; scaling and economics are the next challenge!**

Carbon Farming Workshop

Dion Antonopoulos

Division Director, Biosciences

dion@anl.gov

Relevant experience bio sketch

- Microbiologist by training – molecular biology, genomics, bioinformatics, metagenomics, microbial ecology…
- Have studied microbes in a variety of contexts and environments – ruminant microbiology, soil microbiology, subsurface microbiology, permafrost, gastroenterology, antimicrobial resistance, digestive diseases, immunology…
- Current interest in synthetic biology and improving the process for biodesign of microbes

Networking & teaming

- What about your work would attendees be interested to know?

Primarily interested in developing and understanding organizational building blocks of microorganisms as they create complex community structures and functions.

- What types of connections are you hoping to make at the workshop?

Broader understanding of discrete targets for carbon manipulations and limits on their permanence.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? *Capturing and reconfiguring carbon for new structures/ functions at scale.*
- What is the primary risk of carbon farming? *Economics of establishing and maintaining decided strategy(ies).*
- What are the ideas in the community that are inspiring you right now? *Novel bioinspired materials.*

Carbon Farming Workshop

Scripps Research

Ahmed Badran

Assistant Professor (Chem + Integrative Structural & Computational Biology

ahbadran@scripps.edu

Relevant experience bio sketch

- 18 years of experience in bioengineering, molecular, chemical, and synthetic biology.
- Expertise: genetic circuit and biosensor development, continuous directed evolution, genome editing, genetic code expansion, translation engineering, metabolic flux tuning.
- Contributed to key technologies: PACE, base editing, untargeted mutagenesis, Bt toxins.
- Strong interest in transformative, sustainable, and rapidly deployable technologies for global carbon capture.

Networking & teaming

Research Program: Cutting edge engineering approaches to improve biomolecular activities; technologies that augment Darwinian evolution speed by >1,000,000-fold to solve problems in carbon capture and large-scale biosynthesis; integrating *de novo* protein design and ancestral protein reconstruction.

Connections: experts in heterologous pathway development, production of high-value commodities, plant engineering and RuBisCO biochemistry, bringing technology to market.

Ideas, questions, and feedback

Carbon farming is an ecosystems-level approach to minimize carbon loss while maximizing long-term agricultural productivity.

Primary risks: co-integration strategies for diverse bioengineering outcomes developed here, lead time from lab to field application, large-scale agricultural practice changes, rising temperature and drought affecting agriculture-based solutions.

Key ideas: intra- & inter-kingdom strategies to improve agricultural carbon capture, other atmospheric gases (N_2 or CH_4 capture).

Carbon Farming Workshop

Terra Economics

Name: Sharon Bard

Title: Principal

Email address: sharonkbard@gmail.com

Relevant experience bio sketch

- I am an agricultural economist specializing in biofuels and sustainable / regenerative agriculture.
- I also farm corn and soybeans with my husband in east-central Illinois.
- Past and current project topics include land cover/use change, sustainable beef (including a block-chain framework), soy biodiesel feedstock carbon intensity score, technologies for evaluating SOC, agricultural N_2O emissions, conservation pay-for-performance pilot, sustainability economics, and voluntary farmer conservation program.

Networking & teaming

- What about your work would attendees be interested to know?
  - I combine the farmer and economic perspective with my knowledge of emerging opportunities to guide all sectors of the supply chain in making strategic decisions about carbon farming.
- What types of connections are you hoping to make at the workshop?
  - Opportunities to learn about new technologies and pathways being conceptualized

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? Carbon products and sequestration / drawdown
- What is the primary risk of carbon farming? Measurement accuracies / economics
- What are the ideas in the community that are inspiring you right now? Thinking beyond “conventional agriculture”; ensuring farmers are part of the conversation / solution

Carbon Farming Workshop

Zach Brenton

Founder/CTO

Zach.Brenton@carolinaseedsystems.com

Relevant experience bio sketch

- PhD in plant genetics and plant breeding
- Inventor of numerous commercialized plant varieties/hybrids
- Leads integrated genomics-enabled crop breeding program
- Co-founded Carolina Seed Systems – spinout from Clemson University
- Experience with commodity, bioenergy, and bioindustrial crop improvement
- Prior ARPAe recipient (TERRA program)

Networking & teaming

- What about your work would attendees be interested to know?

-We have an integrated genomics-enabled crop improvement program (chiefly sorghum) and are interested in using this technology to create ‘carbon-negative’ crops for the southern US

- What types of connections are you hoping to make at the workshop?

-Looking to find new technologies and collaborators that would enable the breeding of carbon negative crops
-Interested in partnering with novel methods for feedstock conversion/utilization

Ideas, questions, and feedback

- Carbon farming: The purposeful employment of techniques/technologies to remove atmospheric carbon **OR** utilizing crop agriculture to directly replace fossil fuels for energy or industrial processes

- primary risk of carbon farming: bad government policy

Stanford University

Jennifer Brophy

Assistant Professor of Bioengineering

jbrophy@stanford.edu

Relevant experience bio sketch

- 14 years experience in synthetic biology
  - Developed a tool for engineering Gram-positive soil bacteria (Brophy et al., 2018)
  - Created synthetic genetic circuits in plants
- Plant Biology
  - Engineered specific aspects of plant root structure using circuits (Brophy et al., 2022)
- Education:
  - BS, Bioengineering @UC Berkeley
  - PhD, Biological Engineering @MIT
  - Postdoc, Plant Biology @Stanford

Networking & teaming

- I'm looking for collaborators!
- My lab can help build synthetic genetic programs to precisely control the expression of plant genes across tissues and over time. We think this could be useful for controlling the growth of individual plant tissues *(e.g.*, making longer roots), but are open to all potential directions.

Ideas, questions, and feedback

- Carbon farming is growing plants specifically to sequester carbon.
- The primary risk is expending more CO_2 growing the plants than is sequestered by the plants.
- I'm inspired by regenerative farming approaches and what may be possible with no-till farming.

Carbon Farming Workshop

Teal Brown Zimring

Executive Director

teal@galvanizepartners.com

Relevant experience bio sketch

- Wildfire mitigation and biomass markets expert – UC Berkeley Carbon Removal Lab, California Joint Institute for Wood Product Innovation, California Forest Carbon Plan, Chair of CA Biofuels Equity + Development Working Group.
- Political economist and Founding Partner of Galvanize Partners – a climate economics, policy and advisory firm with a specific focus on convening, ecosystem and network building.

Networking & teaming

- What about your work would attendees be interested to know?

Lab to Land is developing syn bio technologies which offer climate resilience and carbon removal in partnership with a network of global laboratories – and simultaneously building the necessary commercial, regulatory and socio-cultural ecosystem to implement and scale.

- What types of connections are you hoping to make at the workshop?

Partners investing in syn bio; commercialization partners interested in scaling syn bio technologies in climate change– particularly in wildfire, forestry, and ag markets.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?

Long-term sequestration of carbon using new technologies or practices on agricultural and natural lands.

- What is the primary risk of carbon farming?

Long-term sequestration of carbon. Deploying at scale in the time that we need. Potential perverse incentives of valuing carbon over ecosystem services.

- What are the ideas in the community that are inspiring you right now?

Microbial CDR, standard setting for soil CO2 measurement, examining land + water rights alongside carbon farming.

Carbon Farming Workshop

Edward Buckler

Senior Scientist

Adj Professor, Cornell University

ed.buckler@usda.gov

Relevant experience bio sketch

- Crop geneticist with 30 years experience in maize genetics, breeding, evolution and genomics
- Developed key approaches for dissecting and applying natural variation in 1000s of species
- Experience with maize, sorghum, switchgrass, gamagrass, and cassava in US and developing world contexts
- Lead ARS efforts to accelerate breeding in dozens of specialty crops

Networking & teaming

- 11% of US GHG are the result of how nitrogen moves through the Ag system
  - Leading a group of 27 labs to de-nitrify maize systems
  - Sequenced the genomes of hundreds of perennial species closely related to maize, sorghum, and Miscanthus. These species have adaptations for carbon farming in numerous environments
- Connections: Researchers interested in changing field nitrogen cycles and growing seasons of crops (expanding to winter).

Ideas, questions, and feedback

- Carbon farming: Using biological approaches to harvest atmospheric carbon
- Risk: Soil carbon cycles in productive soils with good aeration.
- Ideas: Catalytic amino acid and non-protein nitrogen production allows field crops to recycle protein – rather than deliver nitrogen for human and animal nutrition.

Carbon Farming Workshop

Gnosys, Inc.

Jonathan J. Burbaum

Founder & Principal

jonathan@gnosys.consulting

Relevant experience bio sketch

Gnosys provides life science business development and technology consulting.

A former Program Director at ARPA-E (PETRO, OPEN 2012, TRANSNET), & T2M Advisor.

Seminal roles with numerous venture-backed startup companies, on both sides of the table.

PhD Harvard 1988 (Organic Chemistry)
MBA UCSD 2009 (Entrepreneurialism)

Networking & teaming

- Deep knowledge of the relationship between the biochemistry of carbon capture and photosynthetic efficiency
- Technoeconomic analysis in energy technologies, primarily identifying and elaborating on beachhead markets
- Passionate about technology's intrinsic capability to change the world for the better

Ideas, questions, and feedback

- Carbon Farming: Air capture of CO_2 using photosynthesis funded by carbon credits.
- Primary Risk: Sketchy carbon accounting using offsets
- Favorite Ideas:
  - Improving irrigation
  - Satellite measurements of carbon retention (not just NPP) by agriculture that can be monetized directly.

Carbon Farming Workshop

Wolfgang Busch

Professor and Co-Director

wbusch@salk.edu

Relevant experience bio sketch

- Co-Director Harnessing Plants Initiative, Salk Institute for Biological Studies, La Jolla, CA, USA: *Developing plant varieties with enhanced carbon sequestration capabilities for removing CO_2 from the atmosphere*
- Professor, Salk Institute for Biological Studies, La Jolla, CA, USA: *Studying genes, genetic networks, and molecular processes determine root growth and its responses to the environment*

Networking & teaming

- We use genetics, genomics, molecular approaches and systems biology to identify and engineer plants to store more carbon for longer in the soil
- looking for advocates, partners and collaborators

Ideas, questions, and feedback

- *Carbon farming*: farming with carbon accounting; adding more carbon for longer into the soil and/or reducing current AG net GHG emissions
- *primary risk*: non-rigorous carbon accounting
- *ideas*: plant traits for storing carbon in soils and avoiding AG GHG emissions

Carbon Farming Workshop

Carbo Culture

Name: Christopher Carstens

CTO

Chris@Carboculture.com

Relevant experience bio sketch

- I am a Mechanical Engineer and inventor with a lifelong passion for finding simple solutions to seemingly complex problems.
- I have focused on carbon capture and storage for more than 20 years
- My technical expertise includes thermodynamics, carbon capture, nano materials, advanced combustion cycles, gas separation and storage as well as biofuels
- I served on the DOE Methane Hydrate Advisory Committee

Networking & teaming

- I am an “expert” in biochar, having worked on this pathway for more than a decade. I am eager to discuss everything in the biochar supply chain from feedstock, to production, to applications from composting to battery anodes.
- I am hoping to connect with other parties interested in rapid carbon drawdown via the conversion of biomass carbon into durable biocarbons. I would also like to share some of my learnings over the past decade.

Ideas, questions, and feedback

- Carbon Farming, or as we call it Carboculture, is the management of the land and sea for maximizing carbon removal from the atmosphere.
- The primary risk of carbon farming is that it is not done in the most effective manner.
- I am inspired by the idea of direct burial of biomass as well as some of the more advanced applications for biocarbons

Carbon Farming Workshop

YARD STICK Soil Carbon Revealed

Kelsey Chan

Head of Customer Success

kelsey@useyardstick.com

Relevant experience bio sketch

- Currently leads partnerships and customer success for soil carbon measurement projects across commercial and R&D work at Yard Stick
- Previously involved in early concept testing for carbon insetting program at WeWork

Networking & teaming

- We are developing an in situ spectral probe for SOC + BD and need access to land for training data
- We also provide a software solution for stratification, sample plan design, sample tracking, and stock quantification
- We've previously won ARPA-E, NSF SBIR, and (probably) CDFA grants in the past; keen to partner on MRV innovation proposals

Ideas, questions, and feedback

- Carbon farming = applying practices to land known to improve rate of carbon sequestration
- Primary risk = soil C sequestration can be challenging to measure accurately, so care needs to be taken to ensure integrity of carbon farming markets
- Ideas inspiring me = carbon farming on land types beyond common cropping/grazing contexts

Carbon Farming Workshop

Victoria Chernow

Venture Investor

vchernow@playground.global

Relevant experience bio sketch

- Victoria Chernow is currently an investor at Playground Global, an early stage deeptech VC. She previously worked at In-Q-Tel, a strategic VC which invests in cutting-edge technologies with high national security impact. Victoria served as a Fellow at ARPA-E, exploring bioengineering for materials synthesis and carbon sequestration. She received her PhD in Materials Science from Caltech. She has also worked as a research scientist developing sustainable surface coatings for seeds and agricultural chemicals.

Networking & teaming

- What about your work would attendees be interested to know? Looking to identify promising ag and emissions innovations that require venture backing to launch and scale.

- What types of connections are you hoping to make at the workshop?
  Scientists and engineers with entrepreneurial aspirations; experts in the field; other investors and program directors

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? Biogeochemical methods for extended sequestration of atmospheric carbon in agriculture.

- What is the primary risk of carbon farming? Carbon farming should not disincentivize other agricultural best practices.

- What are the ideas in the community that are inspiring you right now? Accelerated mineralization; multiplex plant genome engineering

Carbon Farming Workshop

Nora Cohen Brown

Head of Market
Development & Policy

nora@charmindustrial.com

Relevant experience bio sketch

- I lead Market Development and Policy at Charm Industrial, where we are working to permanently remove carbon from the atmosphere by using pyrolysis to produce a carbon rich bio oil that is permanently sequestered underground. My portfolio includes all of our government and stakeholder partnerships. Prior to joining Charm, I worked in ocean science and climate data, as well as at the White House during the Obama Administration.

Networking & teaming

- What about your work would attendees be interested to know?
- Charm is converting waste biomass to a carbon rich bio oil in order to permanently remove carbon and store it permanently underground

- What types of connections are you hoping to make at the workshop?
- I'm looking to connect with potential partners related to all aspects of our work, including biomass supply, efforts to increase the carbon in biomass, MRV, etc.

Ideas, questions, and feedback

- *In 10 words or less, what is carbon farming?*
- Using technology to improve the carbon value of biomass/farming
- *What is the primary risk of carbon farming?*
- Balancing MRV, Costs, and Efficiency in improving practices
- *What are the ideas in the community that are inspiring you right now?*
- I'm excited about the many innovators involved in creative climate solutions related to farming and biomass

Carbon Farming Workshop

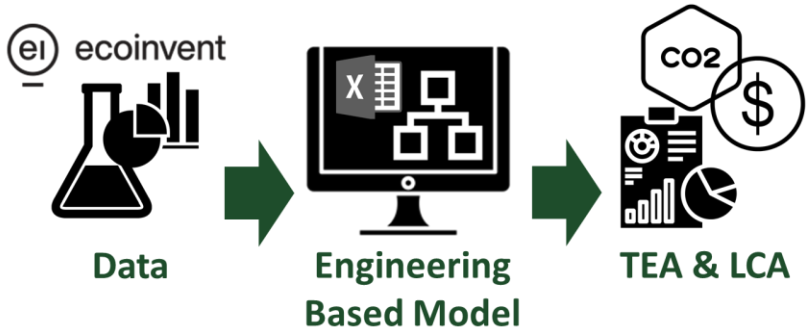
WALTER SCOTT, JR. COLLEGE OF ENGINEERING
COLORADO STATE UNIVERSITY

Garrett Cole

Research Associate

Garrett.M.Cole@colostate.edu

Relevant experience bio sketch



Quantifying the compromises between cost and environmental impact to inform experimental research and guide project direction through Life Cycle Assessment (LCA) and Techno-economic Analysis (TEA).

Networking & teaming

- We are performing concurrent lifecycle and techno-economic assessments of emerging renewable energy, food, and water systems
- To identifying performance targets for the commercial viability and sustainability of technologies
- With experience in agriculture based carbon accounting
- We are seeking high quality data to underlie the engineering process flow models that are the basis for concurrent lifecycle and techno-economic assessments

Ideas, questions, and feedback

- Carbon farming is: Shifting the carbon cycles equilibrium point by increasing soil carbon
- Accounting for and managing carbon sequestration reversals is a primary risk
- Seeing smoke in the skies over Colorado, I find forest management and carbon stock durability an inspiring topic.

Carbon Farming Workshop

Virtual Attendee

Jack Cornell

Director of Sustainable Supply

jcornell@unitedsoybean.org

Relevant experience bio sketch

- 6 years of experience working for commodity organizations where I had a focus of sustainability.
- Had leadership role for a nonprofit organization whose goal was soil health research that worked with over 200 individual farmers in 16 different States.
- 9 years experience in Ag Industry in the Breeding Technology and Applied Field Research Tools for farmers.
- Masters in Plant Science.

Networking & teaming

What about your work would attendees be interested to know?

- I have a background of making conservation research real and tangible for farmers. I have a strong desire to finding sustainable solutions that bring on-farm profitability.

What types of connections are you hoping to make at the workshop?

- I want to multiply USB's efforts in sustainability research by enhancing our partnerships. Finding partners that can help impact the funding systems for farmers around the sustainability markets.

Ideas, questions, and feedback

In 10 words or less, what is carbon farming?

- Opportunity to improve farm profitability and sustainability practices.

What is the primary risk of carbon farming?

- Lost opportunity to create a system that pays farmers for their stewardship of the land.

What are the ideas in the community that are inspiring you right now?

- Farmers know the carbon/sustainability systems do not give them max benefit and they bear all the risk.

Carbon Farming Workshop

Evan H. DeLucia

Professor

delucia@Illinois.edu

Relevant experience bio sketch

- Physiology and ecosystem ecology of agricultural and native ecosystems
- Sustainability of bioenergy crops
- Effectiveness of enhanced weathering as a carbon reduction strategy
- Development of MRV strategies

Networking & teaming

- What about your work would attendees be interested to know?
  - Efficacy of enhanced weathering (EW) for C storage in agricultural ecosystems
  - Potential for perennial bioenergy feedstocks for building SOC
  - Methods for MRV
- What types of connections are you hoping to make at the workshop?
  - Private sector collaborations?

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
  - Management practices that increase SOC, where ΔSOC is additional, permanent, verifiable, and derived from a full LCA
- What is the primary risk of carbon farming?
  - Violation of additional, permanent, verifiable, LCA
- What are the ideas in the community that are inspiring you right now? Enhanced weathering and land use change

Carbon Farming Workshop

Robert Egbert

Senior Staff Scientist

Robert.Egbert@pnnl.gov

Relevant experience bio sketch

- **PI, Persistence Control Science Focus Area,** Secure Biosystems Design Program (DOE BER)
  - Partnered with LBNL, ONRL, UCB, UCSB, UW (Seattle)
- **Microbial synthetic biology**
- **Genetic circuit design**
- **High-throughput genome editing**
- **Rhizosphere microbiome engineering**

Networking & teaming

- What about your work would attendees be interested to know?
  - **Developing novel biocontainment approaches to control the environmental persistence of engineered microbial functions in the rhizosphere**
- What types of connections are you hoping to make at the workshop?
  - **Collaborations on discovery & engineering microbial traits to promote plant growth and soil carbon deposition**

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? **Hyperaccretion of stable below-ground biomass, structural/compositional soil enrichment**
- What is the primary risk of carbon farming? **Near-term scalability**
- What are the ideas in the community that are inspiring you right now? **Mineral-mediated carbon storage and harvest**

Persistence Control @PNNL

arpa·e CHANGING WHAT'S POSSIBLE

Carbon Farming Workshop

Chris Eiben, PhD

Founder, CEO

ceiben@perlumi.com

PERLUMI

Relevant experience bio sketch

I received a PhD in Bioengineering from UC Berkeley under the direction of Prof. Jay Keasling. After grad school, I founded Perlumi, a startup working on novel carbon fixation routes. I'm generally interested in building companies with gigaton scale CO_2 impact. On the academic side, I've authored many publications in peer reviewed journals, including Nature Biotechnology and ACS Synbio. I was awarded the prestigious Activate fellowship, and NSF-GRFP fellowship. In total, I've been working in the synbio field for 12 years.

Networking & teaming

- What about your work would attendees be interested to know?

I'm working on plant based routes to have gigaton scale CO_2 impact. Current research focus is around novel carbon fixation pathways.

- What types of connections are you hoping to make at the workshop?

I'm interested in meeting people who have worked for big Ag companies, and entrepreneurs in the Ag space.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?

Profitable diffuse CO_2 capture and storage leveraging biology.

- What is the primary risk of carbon farming?

How MRV will effect carbon prices compared to more easily verifiable competing tech (e.g. pumping CO_2 into rock formations). How big and durable can voluntary carbon markets be if government involuntary markets are slow to materialize.

- What are the ideas in the community that are inspiring you right now?

The positive signs that voluntary carbon markets are functioning today (albeit small), and are gaining momentum.

Carbon Farming Workshop

Elhan S. Ersoz, Ph.D.

Technical Lead

elhan@x.team

Relevant experience bio sketch

- Population, Quantitative, and Evolutionary Genetics
- Statistical, Mathematical and Machine Learning Modeling of omics-to-phenotype in various plant species, in academic and industrial setting (>20 years expertise).

LinkedIn
google-scholar

Networking & teaming

- Developed and applied multiple ML and AI applications for rapid and robust crop improvement with multi-omics and meta data integrations for prescriptive breeding, specific focus on corn and soybeans.

- Connections that can provide insights to alternative approaches to solve carbon farming as well as carbon-market problems.

Ideas, questions, and feedback

- Leveraging existing agricultural ecosystems specifically for the purposes of improved carbon capture.

- Farmer acceptance and market penetration for rapid expansion to large footprint for speciality varieties developed for carbon farming.

- Block-chain for carbon-trading : Crypto Carbon

Carbon Farming Workshop

Virtual Attendee

David Ertl

Technology Commercialization Manager

dertl@iowacorn.org

Relevant experience bio sketch

- Plant (corn) breeding and genetics
- Work in soil health, sustainability issues

Networking & teaming

- We are very involved in soil carbon issues at Iowa Corn both in terms of improving soil health and for potential carbon markets

Ideas, questions, and feedback

- Sequestering carbon in the soil
- Lack of permanence of most forms of soil carbon
- Biochar

Carbon Farming Workshop

Virtual Attendee

Peter Fröhlich

CEO and co-founder,
AgriCircle

peter.froehlich@agricircle.com

Peter engages with innovation leaders and stakeholders across the agri-industry to progress the vision and mission of AgriCircle. He has developed multiple innovation projects at AgriCircle.

Before founding AgriCircle, Peter worked at Syngenta for seven years, where he was part of the country leadership team for Switzerland and EAME.

He is a professional farmer and holds an MBA from the University of St. Gallen and Ing. Agronomics (SHL Zollikofen)

Networking & teaming

- What about your work would attendees be interested to know?
  - AgriCircle makes regenerative agriculture measurable with DORA (dashboard for outcomes of RegenAg) and our ‘precision sampling’ delivering high resolution soil carbon and 19 other soil parameters by combining satellite and soil data.
- What types of connections are you hoping to make at the workshop?
  - We are looking to enter the US market after having offered our services across Europe. It would be great to meet academics, start ups, govt, representatives and farmers interested in all aspects of RegenAg.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
  - Healthier soils, fair price for farmers, nutritious food for consumers and a more sustainable ecosystem
- What is the primary risk of carbon farming?
  - If based on ‘estimations’ rather than accurate measures, carbon farming could lead to an unsustainable bubble.
- What are the ideas in the community that are inspiring you right now?
  - We are very interested in in-field devices to measure soil carbon, which complement our precision sampling technology.

Carbon Farming Workshop

Greeshma Gadikota
Assistant Professor,
Croll Sesquicentennial Fellow
Senior Fellow, Cornell Atkinson Center for Sustainability
Civil and Environmental Engr | Chemical and Biological Engr.
Cornell University
gg464@cornell.edu

Dr. Gadikota directs the Sustainable Energy and Resource Recovery Group. Her PhD in Chemical Engineering and MS degrees in Chemical Engineering and Operations Research are from Columbia University. Her BS in Chemical Engineering is from Michigan State University. She held postdoctoral research associate appointments at Princeton and Columbia, and a research associate appointment at NIST.

She is a recipient of the DOE, NSF, and ARO CAREER Awards, Sigma Xi Young Investigator Award, AICHE Sabic Award for Young Professionals from the Particle Technology Forum, Minerals Young Investigator Award, Cornell Engineering Research Excellence Award, Inaugural Cornell Rising Women Innovator Award, an invited participant in the NAE Frontiers of Engineering, and invited speaker at the NAE German-American Frontiers of Engineering Symposium.

Networking & teaming

Our lab has shown that biochar can be tuned to enhance CO_2 capture and accelerate carbon mineralization. We would like to couple this approach with large scale demonstrations of enhanced weathering coupled with biochar use and mineralization to solid carbonates.

We could offer attendees approaches to accelerate CO_2 uptake and enhance carbon mineralization. Connections with agricultural scientists, and researchers investigating the role of soil microbiome on CO_2 uptake, and industries/large farming cooperatives are of interest.

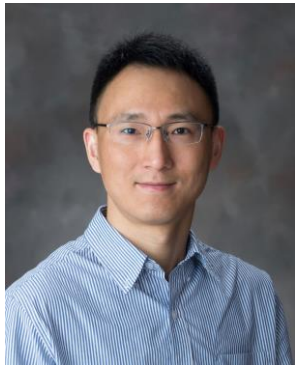
Ideas, questions, and feedback

In 10 words or less, what is carbon farming?
Carbon farming involves harnessing CO_2 from the atmosphere to enhance soil productivity and crop yields.

What is the primary risk of carbon farming?
Some crops thrive in acidic environments while others in basic environments. Therefore, it is essential to determine the physico-chemical interactions modulating carbon transformations in soils and their effect on specific crop yields.

What are the ideas in the community that are inspiring you right now?
Approaches to accelerate carbon uptake in soils, quantification of carbon uptake, and feedbacks effects of CO_2 capture on inorganic and organic carbon in soils are of interest.

Carbon Farming Workshop



Yufeng Ge

Associate Professor

UNIVERSITY of NEBRASKA LINCOLN

Email: yge2@unl.edu

Relevant experience bio sketch

- Training in agricultural and biological engineering and soil science.
- Expertise in rapid and in-situ analysis of plants and soil across scales.
- Expertise in hyperspectral and thermal imaging for crop morphological, physiological, and functional trait analysis.
- Developed field deployable sensors and robotics for automated data collection.

Networking & teaming

- What about your work would attendees be interested to know?
  - Low-cost in-situ soil carbon measurement
  - Above-ground crop measurement, plant phenomics
- What types of connections are you hoping to make at the workshop?
  - Below ground biomass and root measurement
  - Plant genetics to enhance biomass production and resource use efficiency

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? **Crop and soil work synergistically to reduce atmospheric C**
- What is the primary risk of carbon farming? **Leakage and permanence issue. MRV to confirm C storage.**
- What are the ideas in the community that are inspiring you right now? **Probiotics**

Carbon Farming Workshop

Virtual Attendee

Mary Louise Gifford

Director, ESG & Partnerships

mlgifford@fbsciences.com

Relevant experience

- Former IPCC and World Bank climate expert, transitioned to private sector with enviro. engineering + econ background.
- Spearheading climate-smart initiative @ FBSciences– where I now lead the climate task force at The Fertilizer Institute and several partnerships with climate-smart organizations.
- Advising Lab to Land – an investment group in syn bio + climate change on commercialization efforts.
- Consultant on Gates Foundation: Enabling Crop Analytics at Scale project

Networking & teaming

- FBS has a database of 1600+ bioassay, greenhouse, and field trials highlighting the use of our biological (biostimulants & biopesticides) technologies and end-use products for improving plant health and yield– as well as mitigation of GHG through nitrogen efficiency and increase in above and below ground carbon.

- Would like to develop collaborations or partnerships with others interested in the use of agricultural biologicals for climate change mitigation.

Ideas, questions, and feedback

In 10 words or less, what is carbon farming?

- Carbon farming promotes ag practices that enhance soil carbon storage.

What is the primary risk of carbon farming?

- Long-term sequestration of carbon. Behavior change in farming practices.
- What are the ideas in the community that are inspiring you right now?

Using tools that have been long developed in agronomy to optimize the sequestration of GHG in farming.

Carbon Farming Workshop

Virtual Attendee

Angelo Gurgel

Research Scientist

gurgel@mit.edu

Relevant experience bio sketch

- *Research Scientist at the MIT Joint Program on the Science and Policy of Global Change*
- *Economic, environmental and integrated assessment modeling, applied to:*
  - *climate policy, climate change, land-use changes, bioenergy, agricultural and environmental economics.*
- *Former Professor at the Sao Paulo School of Economics, Fundacao Getulio Vargas (FGV), and University of Sao Paulo (USP), Brazil*
- *Coordinated the FGV Observatory of Low-Carbon Emissions in Agriculture*

Networking & teaming

- What about your work would attendees be interested to know?
  - *Potential economic and environmental impacts of nature-based solutions applied at global scale;*
  - *Land use changes and land use competition by bioenergy and nature-based solutions, impacts on food security;*
  - *Potential economic and environmental impacts from double-cropping, crop-livestock-forest systems, and agricultural intensification; policies to incentive those practices;*
- What types of connections are you hoping to make at the workshop?
  - *Researchers, practitioners, institutions and companies interested in developing partnerships to advance knowledge and understanding on the topics listed above*

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?

Agricultural practices able to sequester carbon/reduce ghg emissions

- What is the primary risk of carbon farming?

Several: risk of no permanence, frustrate farms expectations, generate "green washing", reduce agriculture yields and increase food insecurity

- What are the ideas in the community that are inspiring you right now?

New technologies and companies trying to reduce measurement costs; Practices able to increase yields and carbon sequestration in soils

Carbon Farming Workshop

Virtual Attendee

William Hammond
Asst. Professor of Plant Ecophysiology
Agronomy Department
University of Florida
williamhammond@ufl.edu
ecophyslab.com

My research program is focused on plant death in the Anthropocene. Specifically, as a plant ecophysiologist and global change ecologist, I am interested in the mechanisms of climate-induced plant stress and mortality, and how further warming of the Earth system may amplify the frequency and intensity of globally-observed pulses of plant mortality, from forests to fields, especially during hotter-drought.

For developing carbon markets, knowing the limits of live (and thus, carbon capture) are an important facet—to make sure the carbon farming system of tomorrow is climate resilient, we must know the limits of plants to climate-induced stress.

Networking & teaming

- What about your work would attendees be interested to know?

I study plant death in the Anthropocene – how hot is too hot, and how dry is too dry for plants on our warming planet? How will vulnerability of plants to climate-induced mortality impact carbon farming?

- What types of connections are you hoping to make at the workshop?

Meet collaborators who could benefit from a plant ecophysiologist on their team with expertise in plant stress and mortality.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?

Prioritizing carbon capture over productivity

- What is a primary risk of carbon farming?

Plants are vulnerable to climate-induced mortality

- What are the ideas in the community that are inspiring you right now?

Confronting the climate crisis by developing a new carbon-farming economy; slowing/reversing agricultural land area use

Carbon Farming Workshop

Rebecca Hanes

Modeling and Analysis Engineer

rebecca.hanes@nrel.gov

Relevant experience bio sketch

- I apply a variety of modeling methods to represent large-scale industrial and agricultural systems and provide sustainability-related decision support.
- My background includes chemical engineering, life cycle assessment, optimization, system dynamics, and statistics.
- I've worked in bioenergy, wind energy, industrial supply chain analysis, and the circular economy, among other areas.

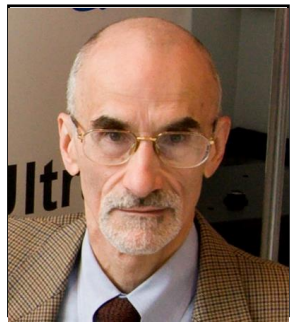
Networking & teaming

- I tend to be technology agnostic and I'm interested primarily in how do we evaluate carbon farming technologies (a) accurately and (b) so technologies can be compared on an equal basis.
- I'm hoping to connect with other systems thinkers interested in looking at how carbon farming technologies might affect and be affected by exogenous factors (complementary technologies, market factors, policy decisions, etc.)

Ideas, questions, and feedback

- A system for achieving long-term absolute reductions in atmospheric GHGs
- A primary risk is that carbon farming technologies will be evaluated using a too-narrow system boundary, resulting in economic, environmental, and social consequences that don't become apparent until the technologies are widely deployed.
- I'm inspired by many recent publications that look critically at applying existing assessment methods to carbon farming and related technologies.

Virtual Attendee



UF IFAS UNIVERSITY of FLORIDA

Name: Andrew D Hanson

Title: Eminent Scholar

Email address: adha@ufl.edu

Relevant experience bio sketch

- Background in metabolic biochemistry & engineering of plants & microbes
- Longstanding interest in crop respiration & its engineering to increase net carbon gain
- Current research in synthetic biology, especially *continuous* directed evolution of enzymes
- Worked in industry & university crop sci depts

Networking & teaming

- What about your work would attendees be interested to know?
  - We are evolving plant enzymes to lower their C cost
  - Our analyses indicate there is much scope to lower C costs this way, i.e. to cut respiratory C loss from crops & so make more C available for existing C sinks or new added sinks such as refractory C-rich polymers for soil C sequestration.
- What types of connections are you hoping to make at the workshop?
  - Soil carbon, crop gene editing, photosynthetic C fixation

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
  - Using field and forest crops to draw down atmospheric CO_2
- What is the primary risk of carbon farming?
  - Ill-informed planning that builds in unrealistic expectations
- What are the ideas in the community that are inspiring you right now?
  - Forest trees have C surpluses, crops can be given them

Carbon Farming Workshop

Chuck Hassebrook, Director Biochar Policy Project, National Center for Appropriate Technology
hassebrook@gmail.com

Relevant experience bio sketch

I served 36 years with the Center for Rural Affairs, including 17 years as Executive Director, where we won federal conservation, rural development and agricultural research policy reforms. My expertise is in agricultural and rural policy, as well as farming systems. Served 18 years on University of Nebraska Board of Regents, including two terms as chair.

Networking & teaming

- What about your work would attendees be interested to know?

We are working to qualify biofuel coproduced with biochar under the federal Renewable Fuel Standard, to provide low carbon fuels for aviation and ocean-going vessels.

- What types of connections are you hoping to make at the workshop? I hope to build connections within the Department of Energy and with other people and organizations working on carbon farming.

What is carbon farming?

- *Soil carbon sequestration that is lasting and additional.*

What is the primary risk of carbon farming?

- *That it will not be additional or lasting and undermine efforts to address climate.*

What is inspiring you right now?

- *In addition to sequestering carbon in soil, appropriately designed biochar can reduce nitrous oxide and methane emissions from soil and slow breakdown of native soil carbon.*

Carbon Farming Workshop

LanzaTech

Chad Haynes

Dir. of Government Strategy

Chad.Haynes@lanzatech.com

Relevant experience bio sketch

- 15+ years bioenergy/bioproducts project development and management
- Technical due diligence assessment
- Contracting and compliance
- Technical communications, Gov relations, and policy
- Experienced consultant serving government and numerous industry sectors
- PhD Biochemistry (Structural Enzymology)

Networking & teaming

- What about your work would attendees be interested to know?
  - Microbial gas fermentation of waste industrial emissions (from steel production) to ethanol has been commercially scaled.
  - Yet a broad range of gas streams, including syngas that can be generated from biomass resources through gasification, can serve as input for gas fermentation.
  - Gas fermentation microbes can be engineered to produce industrially important compounds such as acetone and IPA.
- What types of connections are you hoping to make at the workshop?
  - Biochar experts, soil carbon [microbiome] scientists, systems engineers, etc.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? Technologies and systems that use only “above ground” carbon resources for the enhancement of natural systems, and the production of sustainable fuels and chemicals.
- What is the primary risk of carbon farming? Making sure that carbon that is mobilize to the soil is maintained in the soil and increases over time.

Carbon Farming Workshop

Kirsten Hofmockel

Sr. Scientist

Kirsten.hofmockel@pnnl.gov

Relevant experience bio sketch

- President of the Soil Ecology Society
- Liaison to the U.S. National Committee for Soil Sciences
- PI of Soil Microbiome Science Focus Area at PNNL
- Joint Appointment in Department of Agronomy at Iowa State University

Networking & teaming

- I focus on the influence of plant-microbe ecology on soil biogeochemistry.
- I'm interested to network with modelers and plant scientists to discuss how plant-microbe-mineral interactions can be managed to increase soil carbon
- I would like to learn more about perspectives on quantifying soil carbon across diverse landscapes and calculation and issuance of carbon credits

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? Managing soils to increase net carbon accrual and sequestration.
- What is the primary risk of carbon farming? Measuring persistent soil C is challenging. Activity that builds organic carbon on one soil type might be ineffective on a different soil. In some cases, if C is truly sequestered, soil fertility may be reduced because nutrients are bound to organic C.
- What are the ideas in the community that are inspiring you right now? Deep soil C storage

Carbon Farming Workshop

Brandon Hunnicutt

Owner/Partner Hunnicutt Farms

dirtpoorfarmer@gmail.com

Relevant experience bio sketch

- Corn, soybean, popcorn farmer at Hunnicutt Farms for last 20+ years
- Chairman Field to Market
- National Corn Growers Association Board of Directors

Networking & teaming

- What about your work would attendees be interested to know?

We are constantly trying to make our farm more “sustainable” through crop production practices and irrigation.

- What types of connections are you hoping to make at the workshop?

How to bridge the gap between farmers and others.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? Using the whole farm to capture carbon.
- What is the primary risk of carbon farming? Doing all the right things and not being financially rewarded for it.
- What are the ideas in the community that are inspiring you right now? Utilizing the soil and its microbes to lessen our usage of synthetic fertilizers.

Carbon Farming Workshop

Krishna Jagadish

Professor & Thornton Distinguished Chair
(Crop-Forage-Livestock systems)

kjagadish.sv@ttu.edu

Relevant experience bio sketch

- Perennial grasses and alternative forages for long term carbon sequestration under water limited environments
- CO_2 responsive C_3 cereals for above and below ground carbon sequestration, increased carbon capture per unit area
- Root morphology and anatomy related changes to drought stress in sorghum, rice, wheat
- Stomatal diversity, stomatal complex area and water use efficiency in sorghum

Networking & teaming

- What about your work would attendees be interested to know
  - ➢ Perennial and alternative forages for drought prone regions
  - ➢ CO_2 responsive C_3 cropping landscape in the US
- What types of connections are you hoping to make at the workshop?
  - ➢ Carbon sequestration network for perennial and alternative forages under challenging environments
  - ➢ Genetic engineering - major C_3 crops for CO_2 responsiveness

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
  - ➢ Long term carbon capture leading to net zero emissions
- What is the primary risk of carbon farming?
  - ➢ Release of sequestered CO_2 back to the atmosphere
- What are the ideas in the community that are inspiring you right now?
  - ➢ Low cost, greenhouse gas quantification and scaling from farm to regional scale

Carbon Farming Workshop

Virtual Attendee

William Johnson

MICHIGAN AEROSPACE
OUR WORLD AND BEYOND

Chief Technology Officer

wjohnson@michiganaerospace.com

Relevant experience bio sketch

- Develops and commercializes technology, from basic and applied R&D to licensing and business creation.
  - Aerospace
  - Environmental
  - Biomedical
  - Machine Learning
- R&D efforts include government and industry contract work, internally-funded innovation, and technology incubation.
- We license our technology to strategic partners for product acceleration and also license intellectual property from 3rd parties.
- Key customers include: Fortune 500, DoD, NASA, DOE, EPA

Networking & teaming

- Develop remote measurements for the past 25+ year
- Excel in prototype development, field deployment, and data analytics
- Performer under SMARTFARM SBIR, developing an autonomous drone based N_2O flux sensor to monitor commercial farmland GHG emissions
- Looking for lead agriculture/farming expert that is looking to fill a gap in sensing need

Ideas, questions, and feedback

- How important is sensing at current time and future stages?
- What are the performance metrics?
- What are the unmet sensor needs?
- Can the market support sensor implementations?

Carbon Farming Workshop

Brad Justice

VP Emerging Opportunities

Email address

Relevant experience bio sketch

- I am an entrepreneur with experience in early stage startups. I've worked in biotech, plant breeding/licensing, food ingredients and most recently biogeochemical software modeling. My training is in developmental neuroscience, but I enjoy all fields of new science and technology. I was a cofounder of Soil Metrics with Keith Paustian and his lab members at Colorado State University.

Networking & teaming

- What about your work would attendees be interested to know?
  - I started out with Keith Paustian and the COMET-Farm team
  - Indigo does some really interesting DayCent work including a registry compliant model
- What types of connections are you hoping to make at the workshop?
  - All types! I enjoy being a room where I can talk modeling
  - Anyone interested in collaboration

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
  - Solar powered biosystem that can sequester carbon.
- What is the primary risk of carbon farming?
  - Market fragmentation
- What are the ideas in the community that are inspiring you right now?
- Increasing quality, acknowledging the contribution of field practices in compliance markets

Carbon Farming Workshop

San Diego State University

Name: Marina Kalyuzhnaya

Title: Professor (Microbiology)

Email address: mkalyuzhnaya@sdsu.edu

Relevant experience bio sketch

Dr. Marina G. Kalyuzhnaya (PhD 2001)–Professor of Cell and Molecular Biology at SDSU. Dr. Kalyuzhnaya is focused on microbial cycling of single-carbon compounds as newly emerging solutions for crafting a sustainable future for humankind. Her unique expertise includes microbial genomics and physiology, systems biology, and metabolic engineering. She is an author of more than 100 papers, book chapters, and numerous patents related to microbial single-carbon conversion and greenhouse gas mitigation.

Networking & teaming

What about your work would attendees be interested to know?

- We develop biotic solutions to Climate Change and mitigation of greenhouse gases, mainly focusing on methane- and CO_2-derived single-carbon compounds, such as methanol and formate.

What types of connections are you hoping to make at the workshop?

- Partnerships for demonstration studies with arid vegetation.

Ideas, questions, and feedback

- **Carbon farming**: accelerated harvest of greenhouse gases by impowering/restoring microbiomes associated with terrestrial plants.
- What is the primary risk of carbon farming: (1) scalability; (2) acceptability; (3) techno-economic sustainability.
- What are the ideas in the community that are inspiring you right now: ”*reverse chimney*” driven by plant rhizospheres.

Carbon Farming Workshop

Colorado State University

Alison King

Research Scientist

alison.elinor.king@colostate.edu

Relevant experience bio sketch

Alison is currently a member of the MEMS model development team at Colorado State University, led by Francesca Cotrufo. In her prior work as a USDA NIFA Postdoctoral Fellow, she investigated soil mineralogical and microbial controls on soil organic carbon pools their responsiveness to carbon farming practices in cropping systems. Her dissertation examined the influence of soil aggregation on soil carbon storage, N_2O emissions, and crop yield resilience.

Networking & teaming

- What about your work would attendees be interested to know?
    - We are developing a unified mineral capacity index an alternative to soil texture as control on mineral-associated organic carbon dynamics
- What types of connections are you hoping to make at the workshop?
    - Professional contacts

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
    - Biome management for net carbon transfer from atmosphere to biosphere
- What is the primary risk of carbon farming?
    - Any perverse incentive created incentivizing C storage
- What are the ideas in the community that are inspiring you right now?
    - Refreshing our ideas of controls of soil C processing

Carbon Farming Workshop

UF IFAS UNIVERSITY of FLORIDA

Name: Matias Kirst

Title: Professor

Email address: mkirst@ufl.edu

Relevant experience bio sketch

- Background in quantitative genetics, genomics and plant development.
- Research interest in engineering plant traits of exceptional value into agricultural and bioenergy crops.
- Research methods focused on (1) comparative genomics approaches to identify genes underlying unique species traits, and (2) single-cell genomics to uncover lineage regulators.
- Biotech startups in genotyping (exit in 22') and synthetic biology.

Networking & teaming

- What about your work would attendees be interested to know?
  - We are developing bioenergy crops capable of N-fixation by engineering nodule development. Other traits of interest include CAM photosynthesis and biosynthesis of valuable plant products (e.g., sporopollenin).
- What types of connections are you hoping to make at the workshop?
  - High-throughput plant engineering and phenotyping.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
  - Plant-based harvest and storage of atmospheric carbon.
- What is the primary risk of carbon farming?
  - Barrier to market.
- What are the ideas in the community that are inspiring you right now?
  - New approaches to uncover cell lineage regulators to engineer novel cell types and functions

Carbon Farming Workshop

Virtual Attendee

Name Levente Klein

IBM Research

Research Staff Member

Email: kleinl@us.ibm.com

Relevant experience bio sketch

- Levente developed AI driven methods for precision irrigation solutions and satellite-based tree detection using big data technologies and sensor data fusion. The tree detection around power lines can prevent power outages and the method is adopted by more than 10 utilities globally and used for daily operations.
  In parallel he is leading the effort in IBM to create an open-source platform to measure, to quantify and to validate carbon storage in nature-based solutions.

Networking & teaming

- I am interested to develop an open-source data platform for carbon sequestration that is accurate and verifiable to quantify year to year carbon sequestration using satellite data, AI modelling and field sensor observations.

- Machine learning models are as good as the training data used. I am interested to integrate the best data sources that can be used for carbon quantification from farm level to continental scale.

Ideas, questions, and feedback

- Carbon farming can re-capture CO_2 from the atmosphere and storing it back into soil, trees, wetlands or rocks.

- Greatest challenge: Carbon is hard to measure, and missing tools and techniques are impeding the effective operation of carbon market trading.

- Next development step, precision agriculture where decision is fully automated to maximize carbon sequestration.

Carbon Farming Workshop

Dr. Nathaniel Kreel, PhD

Bus. Dev., Research & Discovery

nkreel@agbiome.com

Twenty years in industrial biotechnology focused on plant and microbial biochemistry.

Currently, Business Development for Research and Discovery at AgBiome, a microbial biotechnology company primarily focused on crop protection using biological products with interests to apply in carbon farming industry.

Previously, scientist in animal health company.

Previously, scientist in industrial enzyme company.

Graduate studies on CO_2/O_2 specificity in RuBisCO.

Networking & teaming

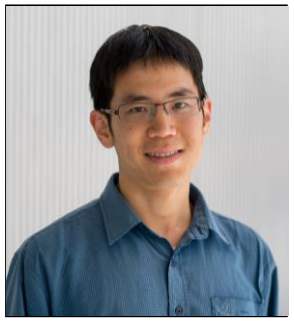
- AgBiome's large collection of isolated and fully sequenced microbes (+100K) with a strong data science engine. With a strong validated assay, our Genesis platform can drive discovery to a "first hit" but discover additional, potentially higher efficacy candidates.
- Learn more about the field, learn and discuss how AgBiome can contribute our platform to the field.

Ideas, questions, and feedback

- Carbon farming in 10 words: Managing balance and altering methods of carbon release and return.
- What is the primary risk of carbon farming? Cost versus reward or ROI, including ability to scale.
- What are the ideas in the community that are inspiring you right now? 3 billion years and trillions of microbial evolution that have it figured out. It's our mission to have them work to our best intentions.

Carbon Farming Workshop

Virtual Attendee



TAKACHAR

Kevin Kung

Chief Technology Officer

kevin@takachar.com

Relevant experience bio sketch

- Concurrent research fellow at the Biomass and Bioenergy Research Group at the University of British Columbia
- 2018-2021: Activate (Cyclotron Road) Fellow at Lawrence Berkeley National Laboratory
- 2017: Ph.D. in Biofuels and Renewable Energy from Massachusetts Institute of Technology
- 2009: M.Phil. in Physics from the University of Cambridge

Networking & teaming

- We are developing processes for decentralized, portable, and customizable conversion of crop/forest residues into higher-value bioproducts such as biofuels, chemicals, and biochar-based fertilizer blends.
- In addition to carbon benefits, I care deeply about building self-sufficient rural communities that are less dependent on international supply chains (e.g. fertilizers) through my work.

Ideas, questions, and feedback

- One can optimize for agronomic outcomes (e.g. harvest yield), or for carbon outcomes (e.g. credits). These two approaches may not always perfectly align (e.g. in designing specific biochar). How does one strike a balance between the two?
- How can we bring the benefits of carbon farming to the most small-scale, underserved communities who are often excluded so far?

Carbon Farming Workshop

IOWA STATE UNIVERSITY
Bioeconomy Initiative

David Laird

Professor Emeritus, ISU
President N-Sense, Inc.

dalaird@n-sense.us

N-Sense

Bio sketch:

PhD, Soil Science, Iowa State University, 1987.

USDA-ARS Research Scientist, 1988-2010.

Professor of Soil Science at ISU, 2010-2018.

Co-founder and President of N-Sense, Inc. 2018→

Author or co-author of 157 refereed journal articles and book chapters on biochar, bioenergy, soil science, clay mineralogy, clay surface chemistry, and environmental science, & 4 patents.

Fellow - American Society of Agronomy.
Fellow - Soil Science Society of America.

Networking & teaming

- Leading expert on biochar, soil science, and the Pyrolysis-Biochar-Bioenergy Platform. Member of XPRISE Carbon Removal Milestone Award winning team.
- Connections with people and institutions that can help make the Pyrolysis-Biochar-Bioenergy Platform grow into an industry that removes ~1 gigaton CO_2–e from the atmosphere every year.

Ideas, questions, and feedback

- ***Carbon farming*:** Practices that build soil carbon levels and soil quality/health.
- ***Carbon farming problem*:** "Credibility" - most forms of soil organic carbon are easily lost.
- ***Solution to the credibility problem*:** Biochar carbon persists for 100s to 1000s of years.
- ***Pathway to ~1 gigaton CO_2-e/year*:** Co-production of biochar and drop-in liquid transportation fuels.

Carbon Farming Workshop

Hiroshi A. Maeda

Associate Professor

maeda2@wisc.edu

My laboratory at University of Wisconsin-Madison utilizes genetics and evolutionary biochemistry approaches to study the regulation of **the shikimate and aromatic amino acid biosynthetic pathways in plants**, which directly connects photosynthetic CO_2 fixation to the production of diverse and abundant aromatic natural products. We are applying the basic knowledge to carry out **plant synthetic biology** for sustainable production of aromatic chemicals using plant chassis.

Maeda lab website: https://maeda.botany.wisc.edu/

Networking & teaming

- My lab recently discovered point mutations that can deregulate the shikimate pathway in plants, which drastically enhanced the production of aromatic compounds and CO_2 assimilation (Yokoyama et al., 2022 *Sci. Adv.* **8**, 23).
- At the workshop, I hope to get connected with potential collaborators for broader application of our technology in “carbon farming” both from academia and industry.

Ideas, questions, and feedback

- “Carbon farming” enables effective CO_2 capturing and sequestering on the land.
- The primary risk of carbon farming could be unintended impacts on terrestrial ecosystem, considering the large-scale operation of carbon farming needed to achieve global impacts.

Carbon Farming Workshop

Jon Margolis

CSO

jmargolis@joynbio.com

Relevant experience bio sketch

Ph.D. UCSD 1993
Postdoc @ Carnegie Inst (Baltimore)

- Worked in Ag research, molecular genetics since 1997.

- Exelixis 96-2005
- AgraQuest 2005-12 (acquired by Bayer)
- Bayer 2012-2018
- JoynBio 2018-present

Networking & teaming

- What about your work would attendees be interested to know?
  - Joyn is a JV funded by Bayer and Ginkgo in 2017.
  - We will we fully acquired by Ginkgo this fall.
  - Flagship project is GM microbes for Nfix on corn.
- What types of connections are you hoping to make at the workshop?
  - Potential collaborators or advisors for carbon program at Joyn; particularly in modelling, analytics, new entry points

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
  - Convert photosynthetically fixed carbon to very long term stable forms
- What is the primary risk of carbon farming?
  - Scaleability, regulatory hurdles, speed
- What are the ideas in the community that are inspiring you right now?

Carbon Farming Workshop

Alison Marklein

Staff Scientist

alison@eion.team

Relevant experience bio sketch

- I am an ecosystem biogeochemist with experience in both organic carbon storage and inorganic carbon capture
- My current focus is on Enhanced Rock Weathering in agricultural ecosystems
- I have expertise in plant-soil-microbe interactions, nutrient cycling, and ecosystem modeling

Networking & teaming

- Our mission to remove C permanently and at scale, with rigorous scientific verification, while providing economic and environmental benefits in rural areas
- We estimate C captured during ERW by measuring alkalinity
- We use high-valence immobile elements as tracers for rock weathering rates

- I'm excited to learn about other C capture quantification methods

Ideas, questions, and feedback

- Carbon farming is: applying novel techniques to capture inorganic and organic carbon long-term
- What is the primary risk of carbon farming? Enabling emitters to postpone reductions, and greenwashing by purchasing carbon that is neither stable nor verifiable
- I'm inspired by ideas relating to MRV and scaling up effectively

Carbon Farming Workshop

Justin Maroccia

Senior Sustainability Manager

jmaroccia@corn.org

Relevant experience bio sketch

- My background is in production agriculture, working on small fruits in South Jersey before studying agronomy with a focus on soil science. At the Corn Refiners Association and the Plant Based Products Council, I lead our sustainability work. In this capacity, my organizations advocate for federal policies that will help reduce agricultural GHG emissions via science-based and incentive-driven voluntary programs.

Networking & teaming

- What about your work would attendees be interested to know?
  - My work is highly policy-focused, so my apologies if I am not as up-to-date as many of the other attendees on current or innovative technologies in this space.
- What types of connections are you hoping to make at the workshop?
  - I'm looking to gain insights on this topic from a more technical crowd to help inform policy recommendations.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
  - An agricultural system expressly designed to maximize carbon sequestration.
- What is the primary risk of carbon farming?
  - No guaranteed permanent sequestration
- What are the ideas in the community that are inspiring you right now?
  - Public-private partnerships in climate-smart ag

Carbon Farming Workshop

Colorado State U,
New West Genetics

John McKay

Professor Plant Genomics

jkmckay@newwestgenetics.com

Relevant experience bio sketch

- John McKay is a Professor of Plant Evolutionary Genomics at Colorado State University. McKay leads a research group on the genetics of adaptation in crops and model systems, with a focus on drought adaptation, carbon sequestration and sustainability. In 2014 McKay co-founded New West Genetics to apply modern genomics and breeding to hemp, a highly productive grain and biomass crop.

Networking & teaming

- Finding genes and breeding lines that leader to greater carbon sequestration and nitrogen use efficiency
- Designing genotypes and rotations for minimizing N2O and maximizing root carbon inputs and durability.

Ideas, questions, and feedback

- Carbon farming is maximizing C sequestration per acre/year
- Market challenges in overcoming subsidized crop production
- Maybe the “sustainable” in sustainable biofuels will become a requirement for that supply chain

Carbon Farming Workshop

Project Mineral, X

Andrew McGowan

Computational Agronomist

andrewmc@x.team

Relevant experience bio sketch

- My work focuses on measuring and modeling soils in agricultural systems and the development of digital tools to support on-farm management.
- Prior to joining Mineral, I worked as Agronomy Lead at Pattern Ag developing tests to quantify microbial communities in ag soils, and as a researcher at The Climate Corporation building models for precision nitrogen management.
- Received Ph.D. in Agronomy from Kansas State University.

Networking & teaming

- What about your work would attendees be interested to know?
  Mineral is building a range of computational agriculture tools to help farmers and breeders see, understand, and embrace the vast complexity of the plant world.

- What types of connections are you hoping to make at the workshop?
  I'd love to learn about your work and see if there are opportunities for Mineral/X/Alphabet to help.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? *Restoring soil carbon and ecosystem function while maintaining production capacity.*
- What is the primary risk of carbon farming? *High cost and uncertainty of monitoring and verification prevent agricultural carbon markets from scaling.*
- What are the ideas in the community that are inspiring you right now? *Increasing calls for open-access datasets for carbon/GHG model calibration and benchmarking efforts.*

Carbon Farming Workshop

Anne Otwell

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy
BIOENERGY TECHNOLOGIES OFFICE

AAAS Science and Technology Policy Fellow

anne.otwell@ee.doe.gov

- Previously: Environmental microbiologist focused on soil microorganisms
  - Graduate school: Cornell University
  - Postdoc: University of Washington, Institute for Systems Biology

- Currently: Fellow in BETO (DOE)
  - Feedstocks Algae Systems Technology (FAST) team
    - Macroalgae (seaweed), resource assessment
    - Feedstocks projects (soil carbon, cover crops)

Networking & teaming

- BETO FAST team appropriated with >$80M annually to tackle challenges in accessing renewable carbon feedstocks for biofuels and bioproducts
  - Interested in technologies that will help lower the carbon intensity of feedstocks for fuels and products

- Very interested in carbon farming and excited to gain deeper understanding of current and future work in the field, including major strategies and barriers. Looking for connections to BETO.

Ideas, questions, and feedback

- A regenerative approach to farming that removes and sequesters CO_2.

- Complex topic so clear and consistent definitions, metrics, and communication with public is key.

- Inspired by more holistic view of farming and its impacts. Inspired by many of the practices related to this topic (e.g., reductions in chemical fertilizers) and excited to learn more.

Carbon Farming Workshop

Virtual Attendee

Wendy Owens

Founder & CEO

wowens@hexas.com

Relevant experience bio sketch

- Wendy Owens is a serial entrepreneur with experience across multiple industries. Hexas combines her background in materials engineering and biotechnology with a passion to save the Earth. Concurrently with past entrepreneurial endeavors, she spent 14 years as an executive-level appointed advisor to the US Secretary of Commerce and US Trade Representative. Ms. Owens is a published author on a variety of subjects and has a MA from Tufts University.

Networking & teaming

- We produce a giant perennial grass that sequesters 15+ tons of carbon/acre/year, the fiber from which can be used in multiple applications from energy to structural and non-structural products.
- I would like to connect with potential customers and collaborators.

Ideas, questions, and feedback

- Carbon farming is the use of plants to sequester long-term carbon.
- The primary risk of carbon farming is the displacement of food crop production.
- I am inspired by multi-byproduct carbon farming that generates multiple revenue streams.

Carbon Farming Workshop

Himadri Pakrasi

Freiberg Professor of Biology

Pakrasi@wustl.edu

Relevant experience bio sketch

- Expertise in Photosynthesis; Systems and Synthetic Biology; Cyanobacteria, Plants
- Elected Fellow, AAAS; ASM
- Member, DOE-BERAC; ASBMB PAAC
- Founding Director, International Center for Energy, Environment and Sustainability, Washington University
- Co-Founder, MOgene LLC, St. Louis, Missouri

Networking & teaming

- I am deeply engaged in evaluating the potentials of phototrophic microbes in enhancing soil health
- I look forward to meeting individuals who are using cutting edge technologies to measure various soil attributes.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? Using biology to sequester and utilize CO_2 in soil.
- What is the primary risk of carbon farming? Incomplete understanding of soil biology that may lead to nonproductive release of sequestered carbon
- What are the ideas in the community that are inspiring you right now? Formation of diverse teams to meet the grand challenges in soil carbon capture and utilization

Carbon Farming Workshop

Jennifer Pett-Ridge

Group Leader, Env. Isotope Systems

PI, *Microbes Persist*, DOE Soil Microbiome Scientific Focus Area

Adjunct Full Professor, UC Merced

pettridge2@llnl.gov

Relevant experience

- B.A. and M.S. from Yale University; Ph.D. from the University of California, Berkeley
- Training in forest ecology, soil biogeochemistry, environmental microbiology and isotope tracing
- Studies plant-microbial interactions for sustainable biofuels and microbiome interactions that underpin soil carbon persistence
- Lead of LLNL *National Getting to Net-Zero* analysis, a US county-level economy-wide evaluation of carbon dioxide removal

Networking & teaming

- We use isotope tracing and whole-plant-soil labeling to quantitatively measure the plant-fixed carbon that makes it into various belowground pools. Then track durability..and also use ^{14}C dating to assess soil carbon turnover time
- What types of connections are you hoping to make at the workshop?

Ideas, questions, and feedback

- Management and engineering to amp natural processes of SOC accumulation.
- Unintended effects: on biodiversity, GHGs, deep soil C loss...
- CRISPR editing to improve crop photosynthetic efficiency, deeper roots. Also, better quantitative/statistical approaches to assess SOC accrual.

Carbon Farming Workshop

Nik Qafoku

Pacific Northwest NATIONAL LABORATORY

Laboratory Fellow and Chief Scientist

Affiliate Professor, CEE UW

Nik.Qafoku@pnnl.gov

Relevant experience bio sketch

- **Education**: Agronomy; Soil chemistry, fertility, mineralogy; Applied mathematical sciences
- **Research interests:**
  - Organic/inorganic carbon and nitrogen cycling, pools and stability in soils
  - Decarbonization of agriculture: soil management practices, GHG emissions
  - CO_2 sequestration in soils and deep subsurface reservoirs; environmental impacts
  - Fate and transport of contaminants in soils
  - Nano minerals and nano scale reaction and processes in soils

Networking & teaming

- My current work in focused on:
  - Stabilization of soil organic matter via interactions with minerals
  - Soil management practices that enhance organic carbon pool in soils and decrease emissions (CO_2, CH_4 and N_2O)
  - Climate induced accelerated soil mineral weathering and carbonate mineral formation
  - Enhanced weathering as a technology to sequester CO_2
  - Coupled inorganic and organic carbon cycling in soils
- Carbon farming should be a multidisciplinary effort; I would like to make connections with scientists from a variety of disciplines

Ideas, questions, and feedback

- Carbon farming should be about: Increasing soil organic/inorganic carbon pools and improving soil fertility
- Potential risks are additional cost to farmers and environmental impacts
- The ideas in the community that are inspiring me right now are those related to discovering pathways of carbon sequestration in soils

Carbon Farming Workshop

Nick Reinke

CEO

Nick.Reinke@HabiTerre.com

Relevant experience bio sketch

- Launched carbon dioxide removal offering with Truterra, working across entire ag value chain from crop inputs, to farmers, to cooperatives, to grain aggregators, to CPGs and offset buyers
- Family farming background in southeast North Dakota, still involved in the farm, primary experience with corn, soybeans, wheat, and beef cattle
- 10 years in crop insurance and ag banking, worked directly with hundreds of farmers and agribusinesses across the upper Midwest

Networking & teaming

- What about your work would attendees be interested to know?
  - It is possible to simultaneously be committed to scientific rigor and commercial scalability when quantifying ag carbon sequestration and GHG emissions
- What types of connections are you hoping to make at the workshop?
  - Innovators and market makers – People looking to develop the new carbon economy at scale

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
  - Amending farming practices to capture and store additional carbon
- What is the primary risk of carbon farming?
  - Practice changes introduce risk into established, entrenched, and long-proven farm management systems
- What are the ideas in the community that are inspiring you right now?
  - Understanding that carbon farming needs to integrate into existing systems and channels and cannot stand alone

Carbon Farming Workshop

GINKGO BIOWORKS™
THE ORGANISM COMPANY

Dan Robinson

Climate Initiative Lead

drobinson@ginkgobioworks.com

Current:
Ginkgo Bioworks Climate Initiative Lead - building out Ginkgo Bioworks' activities across carbon dioxide removal and C1 biomanufacturing, specifically commercial deals, ecosystem partners, and new company creation on the Ginkgo platform

Past:
Early stage venture capital investor with OS Fund, KdT Ventures, Good Energies; startup experience with Global Thermostat, Ionic Materials, Opower

Education:
Dartmouth AB, Wharton MBA

Networking & teaming

- Looking for: companies and academics pursuing CDR strategies that Ginkgo can support; ecosystem partners; ideas for new carbon/climate related companies that we should launch as new ventures

- What types of connections are you hoping to make at the workshop? *Anyone engaged with CDR and bioeconomy related ideation, research, commercialization, funding, strategic advising*

Ideas, questions, and feedback

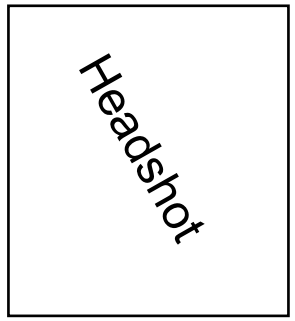
- Carbon farming is the monetization of carbon negativity

- Risks: 1) weak intrinsic merit of specific solutions (i.e., permanence, energy balance, environmental impact), 2) funding of solutions that become stranded assets (e.g., sequestration rather than upcycling, obviation by geoengineering)

- Captured (carbon negative) CO2 as feedstock for bioeconomy (biomanufacturing, building materials)

Carbon Farming Workshop

Virtual Attendee



Jorge L. Mazza Rodrigues

Professor

jmrodrigues@ucdavis.edu

Relevant experience bio sketch

- Soil microbiology with expertise in meta'omics technologies.
- Research areas focusing on land use change, microbial community assembly, C and N biogeochemical cycles in pristine forests and agricultural ecosystems.

Networking & teaming

- What about your work would attendees be interested to know?
  - Laboratory research focuses on soil C stability at the level of the aggregate size under different agricultural management practices. We have experiences with metagenomics, metabolomics and machine learning.
- What types of connections are you hoping to make at the workshop?
  - Others interested in C sequestration processes in agricultural systems.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
- Agricultural practices designed to lock C into soil.
- What is the primary risk of carbon farming?
- Not taking into consideration the C molecule structure (labile vs. recalcitrant).
- What are the ideas in the community that are inspiring you right now?
- To lock C into soil by improving aggregate structure, cover crop design for C delivery.

Carbon Farming Workshop

Joe Sagues

NC STATE UNIVERSITY

Assistant Professor

wjsagues@ncsu.edu

Relevant experience bio sketch

- **Research focus:** Applied research & modeling for the development of carbon-negative bioprocessing technologies
  - Pulp and paper
  - Anaerobic digestion
  - Ethanol fermentation
  - Biomass graphitization
  - Techno-economic analysis
  - Life cycle assessment
- **Background:** PhD in Forest Biomaterials, MS in Chemical Engineering, experience at ARPA-E & NREL

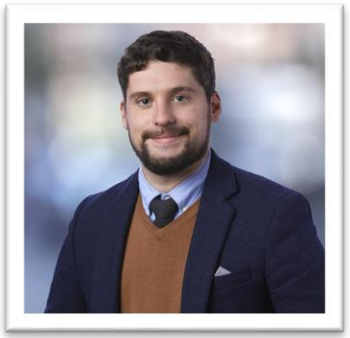
Networking & teaming

- Assessing viable conversion pathways for biomass carbon removal and storage (BiCRS)
- Developing new bioprocesses for valorization and stabilization of biocarbon
- Feedstock suitability for various conversion pathways
- Looking to make connections with experts in emerging biomass feedstocks and stabilization mechanisms for BiCRS

Ideas, questions, and feedback

- Carbon farming generates bioproducts that remove CO2 from the atmosphere
- Reversal of carbon removal via leakage
- Optimizing bioeconomy supply chains for carbon removal

Carbon Farming Workshop



Daniel Sanchez

CARBONDIRECT

Chief Scientist, Biomass carbon removal and storage

dsanchez@carbon-direct.com

Relevant experience bio sketch

- On leave from University of California, Berkeley
- Studies engineered biomass & bioenergy systems that remove CO_2 from the atmosphere
- Aims to commercialize sustainable carbon dioxide removal technologies, and supports outreach to policymakers and technologists in California and across the United States.

Networking & teaming

- Interest in all forms of long-lived carbon storage in products derived from biomass
- Particular focus on market and commercialization pathways
- Hoping to learn new science; meet potential collaborators scaling up high-quality approaches

Ideas, questions, and feedback

- Carbon farming: creating durable forms of carbon storage using the primary productivity of plants
- Risk: low credit quality undermining markets & perceptions
- Inspiring ideas: too many to list!

Carbon Farming Workshop

James C. Schnable

Professor

schnable@unl.edu

Relevant experience bio sketch

James is a professor in the Department of Agronomy and Horticulture at the University of Nebraska where he has published more than 100 peer reviewed papers in journals including Science, Nature, and Proceedings of the National Academy of Sciences. He has founded or co-founded three companies working in the bioinformatics, climate resilient agriculture, and precision agronomy spaces, raising more than $6M from angel and venture investors and $1.3M in small business research grants.

Networking & teaming

- What about your work would attendees be interested to know?

Just how much genetic diversity exists for root traits (both shape and structure) in crops like maize, sorghum, and millet.

- What types of connections are you hoping to make at the workshop?

I'm hoping to get connected with people figuring out both the engineering and economics challenges of tracking water/carbon savings through agricultural supply chains.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?

Farmers making decisions that sequence carbon based on economic incentives.

- What is the primary risk of carbon farming?

Farmers lose money the first year they try it, and stop engaging.

- What are the ideas in the community that are inspiring you right now?

The potential to rapidly scaling water and soil carbon measurements using higher and high res satellite data.

Carbon Farming Workshop

NC STATE UNIVERSITY

Heike Sederoff

Professor

hwsedero@ncsu.edu

Relevant experience bio sketch

- Plant Metabolic Engineering, Sensory Genomics
- Chair, Systems and Synthetic Biology Cluster
- PI – Arpae PETRO (’11-’16) grant – re-engineering carbon fixation and allocation in oil seed crops; synthetic CO_2 fixation cycle
- Other lab projects (current and former):
  - Net-Zero Energy GreenERhouses
  - Re-engineering AM symbiosis into Brassica
  - Algae engineering for bioenergy
  - Genetic Engineering and Society Center

Networking & teaming

- Active in many different work environments and roles – GE policy, commercialization, expert witness for USPTO disputes, from physics to social science and policy. International collaborations with Denmark, Peru, China and in Space (ISS).
- Researchers/Organizers/Companies with bigger picture and willingness to try new things?

Ideas, questions, and feedback

- Carbon Farming is an agricultural approach for long-term removal of atmospheric CO_2 (and other GHG)
- N, P depletion, eutrophication
- Plant based meats, perennials, GH production

Carbon Farming Workshop

Virtual Attendee

Tom Siddiqui

Business Development

tom@regrow.ag

Regrow unlocks the power of resilient agriculture to combat climate change and grow profitability.

Our mission is to make resilient agriculture ubiquitous. On every acre. Globally.

Our vision is for agriculture to be driven by science and technology to restore the environmental balance globally to nourish the population and be equitable for everyone. Environment. People. Equity. In that order.

Networking & teaming

- What about your work would attendees be interested to know? *Attendees would be interested to hear about Regrow's MRV solution and our work with ARPA-E to improve the science and application with DNDC.*
- What types of connections are you hoping to make at the workshop? *We welcome the chance to connect with the broader scientific, government and commercial community.*

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? *Linking regenerative agricultural practices to corporate and governmental sustainability goals.*
- What is the primary risk of carbon farming? *A primary risk to carbon farming is lack of transparent quantification.*
- What are the ideas in the community that are inspiring you right now? *Regrow is inspired by the growing interest from corporate sector and increased focus on science-based climate targets.*

Carbon Farming Workshop

Virtual Attendee

Whendee Silver

Professor, Ecosystem Ecology and Biogeochemistry at UC Berkeley

wsilver@Berkeley.edu

Biogeochemistry in natural and working lands.

Lead scientist: Marin Carbon Project; pioneered carbon farming on rangelands.

Research using organic and inorganic soil amendments: compost, ground rock, biochar

Research on composting organic wastes for emissions reduction and C sequestration

Research using environmental sensing for continuous real-time data on emissions and drivers

Research on croplands, diaries, rangelands, wetlands, tropical forests

Networking & teaming

We conduct field, lab, and modeling research on C sequestration *and* greenhouse gas emissions reductions. We also explore mechanistic drivers, net primary production, and plant community dynamics.

We are developing continuous sensing capabilities for biogeochemical processes.

We are interested in exploring potential collaborations on soil C sequestration research and connections that can help scale field experiments to larger *applied* C reduction pathways

Ideas, questions, and feedback

Carbon Farming: Working-lands management to enhanced C content and ancillary benefits.

Primary Risk: Quantification is a challenge and thus C-seq could be dismissed as being too difficult to quantify for market purposes.

Inspiration: (1) increasing evidence of benefits; (2) collaborations across sectors that bring C farming into the mainstream.

Carbon Farming Workshop

Virtual Attendee

Rafael Simon

CEO

rsimon@silvec.com

SILVEC BIOLOGICS
RNA THERAPIES FOR TREES

Dr. Rafael Simon is the CEO and co-founder of Silvec Biologics. Previously, he was a partner at a leading silicon valley cleantech VC firm where he led the water and agtech investment practice. He also served as COO of ZENON Environmental, the leading biological wastewater recycling company. Previously he worked as a consultant at McKinsey & Co. where he was a co-founder of the Firm's cleantech practice. He holds a Ph.D in engineering from UC Berkeley.

Networking & teaming

- Silvec Biologics has developed the first RNA platform for permanently delivering traits into plants without modifying their genomes.
- I am looking for introductions to companies & institutes that have developed trait modifications for long-lived trees, vines, and bushes that need a low cost method to introduce them into a diverse group of hosts. Our technology can be used to enhance fruit yields, drought tolerance, carbon sequestration, and protect against viruses, bacteria, fungi, and pests.

Ideas, questions, and feedback

- **Definition**: Using plants to enhance long-term carbon sequestration
- **Risk**: That the carbon is pre-maturely released back into the atmosphere
- **Ideas**: Identification of genes to enhance carbon sequestration that can be used across a broad range of plants and trees

Carbon Farming Workshop

Dr. Abhay Singh

asingh@mogene.com

Relevant experience bio sketch

- **Systems analysis of photosynthetic organisms**
- **Microbiome analysis**
- **C1 microbial assimilation**
- **Metabolic engineering of microbes (cyanobacteria, pseudomonad, yeast, methanotroph, etc.)**
- **Microbial inoculants for carbon capture and sequestration, and reducing chemical inputs**

Networking & teaming

- What about your work would attendees be interested to know?

Utilizing photosynthetic microbes to provide multiple benefits to soil and vegetation (carbon capture and sequestration, decarbonization of nitrogen fertilization, and improving soil water-holding capacity)

- What types of connections are you hoping to make at the workshop?
  - Those developing tools to measure various soil attributes and gas flux
  - Those interested in utilizing marginal lands for biofuel crop production and carbon farming

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?

Enhancing terrestrial ecosystems to capture and store more carbon

- What is the primary risk of carbon farming?

Permanence of the captured carbon

- What are the ideas in the community that are inspiring you right now?

Involvement of various stakeholders in developing various tools and platforms to enhance soil's carbon sink capacity

Carbon Farming Workshop

YARD STICK Soil Carbon Revealed

Maxwell Slater

Head of Field Operations

max@useyardstick.com

Relevant experience bio sketch

- 10+ years of experience in the sustainable agriculture industry, with time spent in farmer + brand consultation, as well as land + operations management.

Networking & teaming

- What about your work would attendees be interested to know?
  - We are working on providing rapid, affordable, and scalable in situ measurement of soil carbon.
- What types of connections are you hoping to make at the workshop?
  - Any + all! Would love to meet more practitioners/land managers interested in discussing barriers related to transitioning systems of agriculture, as well as any successes/failures.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
  - Any farming practices geared towards elimination of GHG emissions or carbon sequestration.
- What is the primary risk of carbon farming?
  - Scalability
- What are the ideas in the community that are inspiring you right now?
  - Full service ecosystem service marketplaces; rethinking subsidy programs.

Carbon Farming Workshop

Rachel Slaybaugh

Principal

rachel.slaybaugh@dcvc.com

Relevant experience bio sketch

- I currently invest in climate tech
- I was an ARPA-E program director and managed the ag portfolio there
- My background is in computational methods
- I was a nuclear engineering professor and ran the Cyclotron Road division at LBNL

Networking & teaming

- DCVC has a bio-specific arm, and we invest across stages
- I'd like to meet the best companies in the space
- I'm hoping to learn more about the cutting-edge tech and how that interfaces with the market opportunities in carbon farming

Ideas, questions, and feedback

- Definition: Using arable land and agricultural practices to sequester carbon
- Challenge: Measuring and verifying permanence (is that 2?)
- Most inspiring: grand vision of crop benefit

Carbon Farming Workshop

Virtual Attendee

Rachel Sleighter

Director R&D, Chemistry

rsleighter@fbsciences.com

Relevant Experience

- Ph.D. in Chemistry, with a focus on analytical and environmental chemistry
- Knowledge of natural organic matter and advanced chemical characterization using fluorescence, NMR, and mass spectrometry
- Experience with statistical analysis, including multivariate statistics
- Interested in the use of biostimulants/biologicals to improve plant health, crop yield, and mitigate GHG emissions

Networking & teaming

- FBS has a database of 1600+ bioassay, greenhouse, and field trials highlighting the use of our biological (biostimulants & biopesticides) technologies and end-use products for improving plant health and yield.
- Would like to develop collaborations or partnerships with others interested in the use of agricultural biologicals for climate change mitigation.

Ideas, questions, and feedback

- Carbon farming is agricultural practices that increase the storage of carbon in soils
- The main risk I think of is the release of sequestered carbon back to the atmosphere.
- A recent inspiration is eating more food grown locally, reducing transportation.

H. Smith

Founder

LAPlantGenetics@gmail.com

Relevant experience bio sketch

- PhD research in maize genetics/genomics at Iowa State University.
- Independent plant science research that lead to this project.
- In vitro biosynthesis of SOC in a closed system without the use of soil.

Networking & teaming

- The only organization that has done soil-free carbon sequestration by de novo biosynthesis of Soil Organic Carbon (SOC)compounds. This makes the process more efficient and easier to quantify.
- Looking to partner with individuals/organizations with expertise in soil biochemistry to better understand this novel pathway. Also anyone interested in purchasing solid, stabilized organic carbon compounds.

Ideas, questions, and feedback

- Carbon farming is sequestering atmospheric carbon as a crop.
- The main risk is not getting paid because your method is not one of the standard, recognized methods that organizations will purchase..
- It is great that this area is finally getting attention, but there is not enough focus on innovation in carbon farming even though it is a relatively new field. Hopefully some of that will be

Carbon Farming Workshop

Virtual Attendee

Jenny Soong

Carbon Scientist

Jennifer.soong@corteva.com

Relevant experience bio sketch

- Soil ecologist and biogeochemist with expertise in soil organic matter formation, stabilization and decomposition dynamics
- My work uses field and laboratory experiments to inform model development and verification and to apply biogeochemical models and measurements across agricultural systems
- Currently working in Corteva's Carbon Initiative and R&D
- Formerly worked at Soil Metrics, Colorado State University, Lawrence Berkeley National Laboratory, and University of Antwerp

Networking & teaming

- Corteva seeks effective ways to implement carbon farming at scale with our growers. We have a large sales channel and are seeking partners who can demonstrate the measured carbon and GHG outcomes of their technologies.

- I'd like to see measured results of SOC increases, increased SOC persistence, or GHG reductions at multiple field sites with given Carbon Farming practices

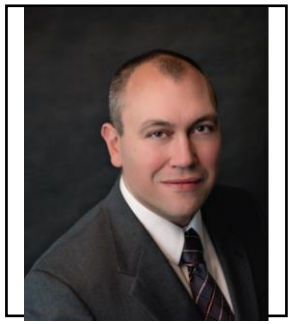
Ideas, questions, and feedback

- C farming is: Measurement of additional impacts of farming on soil carbon and GHGs

- Risks are: too little too late, and unintended adverse consequences (i.e. yield loss and habitat conversion)

- Excited about: New sensing tech and model validation and uncertainty reporting

Carbon Farming Workshop



Chris Souder

R&D Portfolio Lead – Crop Efficiency

chris.souder@bayer.com

Relevant experience bio sketch

- 2007 - Commercial Corn Breeder in Iowa. (Monsanto)
- 2013 - Western Regional Corn Breeding Lead (Monsanto)
- 2015 - North America Product Systems Development Lead (Monsanto)
- 2017 – Midwest Regional Agronomy Lead (Bayer)
- 2022 - R&D Portfolio Lead – Crop Efficiency (Bayer)

Networking & teaming

- My current responsibilities include broad ranging projects including genetic gain, gene editing, grain quality projects, biologicals, and sustainability initiatives in R&D.
- This is my first role within the carbon farming space and I am open to all connections/networking opportunities. I am particularly interested in helping to connect science and policy experts with farmers and ranchers to drive rapid adoption of technology.

Ideas, questions, and feedback

- Providing revenue stream to growers and producers for CO2 sequestration.
- What are long term impacts of on food and feed supply? Validation of CO2 quantities exchanged or stored.
- Increased adoption and integration of cover crops. Advances in autonomous equipment and precision input application.

Carbon Farming Workshop

Chris Topp

Principal Investigator

ctopp@danforthcenter.org

Relevant experience bio sketch

- BA Genetics, PhD Plant Biology
- I run a root phenomics lab specializing in developing imaging and sensing systems for root and rhizosphere biology.
- e.g. we have the leading X-ray CT imaging facility for plant science in the country.
- we run a major field program for root system genetic studies across many crops, cover crops, and potential neo domesticates, including perennials.

Networking & teaming

- our work: (1) we have identified several genes that can tune crop root system architecture in the field, including: root depth, number of primary root axes, and lateral rooting density. (2) we have developed X-ray and other imaging capacity to measure roots, microbes, and soil processes at scales from sub-micron to whole plant.
- connections: we are good at measuring and manipulating plant roots, but working to develop a systems approach by connecting with soil biogeochemists, microbial scientists and multi-scale modelers

Ideas, questions, and feedback

- carbon farming definition: sequestration of atmospheric carbon into recalcitrant plant and soil material
- primary risk: that it is too slow to implement in current Ag systems to be a meaningful solution to climate imperatives
- inspiring ideas: cover crops, perennials and year-round “living roots” | soil chemical legacies | mining and employing wild alleles in rapid breeding and/or synthetic biology approaches

Carbon Farming Workshop

Bjorn Traag

Chief Scientific Officer

bjorn@andes.bio

Relevant experience bio sketch

Ph.D. in microbiology and genetics from Leiden University and postdoc at Harvard, studying cell differentiation and secondary metabolite production in soil microbes. For the past 10 years working in the Synthetic biology and Agtech space in industry, I've focused on the development of climate-friendly bioproducts and biological solutions for sustainable agriculture. I joined Andes in 2021 to head up R&D. At Andes we are developing enhanced microbes, which we deliver through our proprietary seed treatment method to turn farms into mega-factories of carbon dioxide removal.

Networking & teaming

- *What about your work would attendees be interested to know?* At Andes we focus on biology to fight climate change. We deliver soil microbes to the root of plants through our proprietary seed treatment method. There, the microbe is able to thrive and benefit soil health and crop yield. At the same time our microbe promotes carbon dioxide removal from the root environment through enhanced biomineralization.

- *What types of connections are you hoping to make at the workshop?* Looking forward to connect with all.

Ideas, questions, and feedback

- *In 10 words or less, what is carbon farming?* Agricultural practices to increase storage of atmospheric carbon in soil

- *What is the primary risk of carbon farming?* Limited permanence or release of stored carbon due to change of practices

- *What are the ideas in the community that are inspiring you right now?* The focus on enhanced durability/permanence, advanced detection/measurement of soil carbon

Carbon Farming Workshop

Sandra Huynh Truong

Research Scientist

sandra.huynhtruong@corteva.com

Relevant experience bio sketch

- B.S. Applied Mathematics, TAMU
- Ph.D. Genetics, TAMU
- Post-doc Computational Biology, ORNL

Research Scientist in Advanced Modeling and Artificial Intelligence; work focuses on defining, designing agricultural systems, and navigating productivity landscapes for an equitable and sustainable future.

Networking & teaming

- Simplifying complexity can accelerate communication, education, innovation, and adoption. Historically, reductionism often fails to consider the system of interactions resulting in unintended, unexpected consequences.
- Excited to learn from everyone's perspectives and prior knowledge.

Ideas, questions, and feedback

- Carbon farming – removing CO2 through the cultivation of organisms.
- The primary risk is not correctly accounting for residence time.
- Perennial terrestrial crops and aquatic carbon storage

Carbon Farming Workshop

Chao Wang

Associate Professor

chaowang@jhu.edu

Relevant experience bio sketch

- Thermo- and electro-catalysis for carbon conversion, including CO_2 electroreduction and hydrogenation, hydrocarbon (de)hydrogenation/(de)polymerization
- (Electro)chemical process and system engineering, integration of chemical and biochemical reactors for carbon conversion
- Direct air capture of CO_2 and subsequent conversion, utilization and sequestration.

Networking & teaming

- What about your work would attendees be interested to know?
  - We built up an electrochemical system that can continuously reduce CO_2 into C1 or C2 products at >80% carbon conversion efficiencies (CCEs).
  - We invented a DAC system powered by renewable electricity that can capture CO2 at >1 kg/day and >10% energy efficiency for separation.
  - We have a team dedicated to integrating (electro)chemical and biological conversions for carbon fixation.
- What types of connections are you hoping to make at the workshop?
  - We are looking for team partners expertized in soil chemistry and LCA.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?
  - CO2 capture, sequestration and utilization
- What is the primary risk of carbon farming?
  - LCA of biomass carbon underground
- What are the ideas in the community that are inspiring you right now?
  - Potential agricultural benefits of fixed carbon in soil

Carbon Farming Workshop

J. Alan Weber

Partner

aweber@marciv.com

Relevant experience bio sketch

- J. Alan Weber is a founding partner of MARC-IV, a consulting company that fosters the development of biobased innovations, and has been involved with biodiesel commercialization activities since 1991. Alan is a nationally-known economist with extensive experience in the ag industry. He also is a producer himself, farming almost 900 acres with his family in Central Missouri

Networking & teaming

- What about your work would attendees be interested to know?
  - Career focused in development of lipid based biofuels (carbon mitigation); also an ag producer and understand effectiveness of carbon sequestration practices (e.g. cover crops).
- What types of connections are you hoping to make at the workshop?
  - Companies seeking to commercialize IP which can enable ag producers to monetize carbon at the farm level.

Ideas, questions, and feedback

- Carbon Farming—Ability to increase & monetize SOC levels in soil.
- What is the primary risk of carbon farming? Unable to minimize transaction costs and grower payment received insufficient to encourage best practices.
- What are the ideas in the community that are inspiring you right now? Concepts to attribute whole farm practices to carbon accounting (scoring).

Carbon Farming Workshop

Virtual Attendee

Chris H Wilson

Assistant Professor

chwilson@ufl.edu

Relevant experience bio sketch

- Pasture management and biogeochemistry
- Satellite remote sensing for agroecosystem monitoring and modeling
- Mathematical and statistical modeling for plant, soil and ecosystem science
- Stable isotope tracing/probing experiments

Networking & teaming

- What about your work would attendees be interested to know?

I am interested in linking agricultural management practices to long-term carbon storage while accounting for impacts and uncertainties of global change factors. I am most excited about the interface of large-scale data, manipulative experiments, theories and models.

- What types of connections are you hoping to make at the workshop?

Open to a range of connections and excited to see what folks are working on.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming?

Farming that fosters productivity and soil health with carbon sequestration as a co-benefit.

- What is the primary risk of carbon farming?

That we ignore long-range uncertainty and vulnerability of carbon stocks

- What are the ideas in the community that are inspiring you right now?

Greater study of stabilization mechanisms, deep soil processes

Carbon Farming Workshop

Massachusetts Institute of Technology

Robbie Wilson (He/Him)

Research Scientist (Chemistry Dept.)

rhwilson@mit.edu

Bio sketch

- 12 years experience with plant CO_2 assimilation and photosynthesis engineering.
- Core knowledge: RuBisCO biochemistry, directed evolution, gene editing, structural and molecular biology, plant engineering, proteostasis.
- Working with RIPE consortium members for translations applications to the field.
- Interested in gigaton atmospheric CO_2 transfer at a minimum and, in any form, video games, history, sci-fi, travel, gardening, and tasty snacks.

Networking & teaming

My Research Interests:

- We are working at the forefront of molecular engineering and SynBio and looking to enhance natural processes within C-cycles to maximize CO_2 drawdown.

Policy and T2M learning interests:

- Connections to stakeholders directly linked to US agriculture (i.e., what is feasible for farmers, fate of non-harvest biomass). Examples of T2M opportunities for crop biotech.

Scientific learning interests:

- Better understanding of source-to-sink carbon relationships, plant-to-soil carbon transfer, role of fungi and marginal land in Carbon Farming/long term C storage.

Ideas, questions, and feedback

- My perspective: Carbon Farming is *the conversion of agriculture from short-term to long-term carbon storage*.

- Key risks include: Value proposition failure, Carbon vs Food competition, Time between research to deployment at scale, Failure of innovations to translate in the field environment.

Carbon Farming Workshop

Art Wiselogel

ORISE Fellow

art.Wiselogel@ee.doe.gov

Relevant experience bio sketch

- Over 30 years experience working with biofuel and biopower feedstocks
- Supported DOE research in Feedstock Interface
- Worked as a developer in the corn ethanol and wood biomass to power sectors
- Senior Scientist at the National Renewable Energy Lab
- On the faculty at Texas A&M and University of Georgia
- Worked as forester and farmer
- PhD in plant genetics Texas A&M
- MS in Agriculture Oklahoma State
- BS in Forestry Mississippi State

Networking & teaming

- I am working on the development of research and demonstration funding initiatives for the development of Sustainable Aviation Fuel and on carbon dioxide reduction.

- I am hoping to connect with those who develop projects and initiatives in the energy/agriculture/forestry/carbon sector that understand the challenges, opportunities, and issues around implementing a new sector or innovative approaches.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? Growing organisms for carbon storage applications

- What is the primary risk of carbon farming? Accurate measurement technologies to be part of a verification and validation scheme.

- What are the ideas in the community that are inspiring you right now? The integration of carbon avoidance (biofuels) with carbon storage/sequestration

Carbon Farming Workshop

University of Oklahoma

Xiangming Xiao

Professor, https://www.ceom.ou.edu

xiangming.xiao@ou.edu

Relevant experience bio sketch

- Satellite-based measurement, monitoring, reporting, and verification (MRV) of land use and land cover changes (e.g., crops, grasses, forests, and tree plantations), and land management at the field scale
- Satellite-based modeling of vegetation gross primary production and aboveground biomass at the field scale
- Integrated and multi-scale measurements of greenhouse gases emissions in terrestrial ecosystems

Networking & teaming

- What about your work would attendees be interested to know?
  - MRV tools, including satellite-based tools, citizen science tools, and Internet and Communication Technology (ICT) tools
- What types of connections are you hoping to make at the workshop?
  - Connection with stakeholders and decision makers, and private companies

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? Agricultural and forestry management and practices to increase carbon sequestration in vegetation and soils.
- What is the primary risk of carbon farming? Changes in land use and land cover, driven by climate, disturbance, and markets
- What are the ideas in the community that are inspiring you right now? legume-sugarcane intercropping, legume-sugarcane rotation cropping, full use of sugarcane biomass

Carbon Farming Workshop

OAK RIDGE National Laboratory

Xiaohan Yang

Senior Scientist

yangx@ornl.gov

Relevant experience bio sketch

- Genomics of crassulacean acid metabolism (CAM), a special type of photosynthesis enabling plant adaptation to dry environments
- Plant metabolic pathway engineering
- Plant genome editing
- Development of new technologies for plant transformation
- Plant biosystems design in relation to decarbonization
- Plant-microbe symbiosis
- Tree genomics and biotechnology

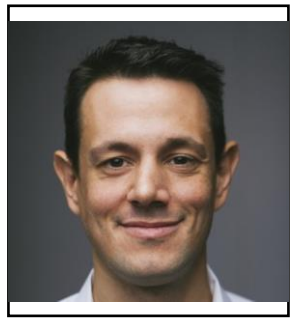
Networking & teaming

- We have created rich genomic resources for CAM plants (*Agave* and *Kalanchoe*).
- We have curated genes for enhancing plant-based carbon sequestration (https://doi.org/10.34133/2021/9798714).
- We have created transgenic plants with enhanced plant growth and abiotic stress tolerance.
- Connections needed: Modeling of plant metabolic pathways and carbon flux, conversion of plant biomass to biochar and biomaterials, field trial of genetically modified plants, techno economic analysis, and genomic selection.

Ideas, questions, and feedback

- Carbon farming is plant-mediated carbon capture, storage and utilization.
- The primary risk of carbon farming is low economic competitiveness.
- Inspiring ideas in the community: Agave-based agroforestry for carbon sequestration on marginal lands; synthetic photosynthesis; biochar for soil health and carbon storage.

Carbon Farming Workshop



Brad Zamft

Project Lead

zamft@x.team

Relevant experience bio sketch

- *Educated as a physicist, trained as a synthetic biologist.*
- *Learned plants are important when helping develop TERRA.*
- *Have been exposed to enough machine learning people that I can sound like I know what I'm talking about in that field for 10 minutes.*
- *Passionate about climate change and equity.*

Networking & teaming

- What about your work would attendees be interested to know? *X is working on plants!*
- What types of connections are you hoping to make at the workshop?
  People who can help do the technoeconomics of plant genetics for climate change. People who want to solve the transformation bottleneck. People who want to join me as a Technical Program Manager.

Ideas, questions, and feedback

- In 10 words or less, what is carbon farming? *$ to farmer for carbon > $ to farmer for food/feed/fuel.*
- What is the primary risk of carbon farming? *You might starve people, or use up all the water.*
- What are the ideas in the community that are inspiring you right now? *Getting back what we lost from ignoring roots.*

Carbon Farming Workshop

Kateryna Zhalnina

Research Scientist

kzhalnina@lbl.gov

Relevant experience bio sketch

- Microbial ecology, genomics, biochemistry
- Plant-microbe interactions
- Exometabolomics of plants and microorganisms
- Soil microbiome (native and synthetic communities)
- Carbon and Nitrogen transformations in soil
- Fabricated Ecosystems

Networking & teaming

- Metabolic handoffs between plants and microbes that drive Carbon and nutrient cycling.
- Teams from other National Labs working on Carbon Farming and potential Industry partners.

Ideas, questions, and feedback

- Harnessing potential of plants, microbes and soil properties to improve CO_2 removal from atmosphere and store Carbon belowground.
- Unexpected consequences to the environment.
- Ability to manipulate microbiomes via tuning natural communities, application beneficial microbiomes, engineering microbiomes.